

CLAIMS

The embodiment of the invention in which an exclusive property or privilege is claimed is defined as follows:

- 1 1. An improved electrolyte for the electrolysis of alumina (Al_2O_3), the electrolyte
2 comprising a mixture of aluminum fluoride (AlF_3) and potassium fluoride (KF).
- 1 2. The electrolyte recited in claim 1 wherein the aluminum fluoride (AlF_3) is present
2 in a molar ratio with potassium fluoride (KF) greater than 1:1.
- 1 3. The electrolyte recited in claim 1, the electrolyte further comprising from about 2
2 to 6 wt. % of aluminum oxide (alumina/ Al_2O_3).
- 1 4. The electrolyte as recited in claim 1 wherein the concentrations of the
2 electrolyte's components remain constant during electrolysis.
- 1 5. The electrolyte as recited in claim 1 where the electrolyte is used to
2 electrolyze the alumina to aluminum at from about 660°C to 1000°C .
- 1 6. The electrolyte as recited in claim 3 wherein the electrolyte remains liquid during
2 electrolysis.
- 1 7. The electrolyte as recited in claim 6 wherein inert anodes and wettable
2 cathodes can be used with the electrolyte.

1 8. A method for using inert anodes and wettable cathodes in the electrolytic
2 production of aluminum comprising using the anodes and cathodes in an electrolysis
3 process at a temperature from between 660°C and 1000°C.

1 9. The method as recited in claim 8 wherein the anode is comprised of a
2 material selected from the group consisting of metals, metal alloys, metal oxides, and
3 cermets.

1 10. The method as recited in claim 8 wherein the alloys are copper alloys
2 (aluminum-bronze) and are from about 1 wt.% to 20 wt.% aluminum (Al).

1 11. The method as recited in claim 8 wherein the cathode is made of a material
2 selected from the group consisting of metal borides, metal boride-carbon composites,
3 metal boride-containing coatings on substrates, graphite, molybdenum, and tungsten.

1 12. The method as recited in claim 8 where the anode contains an oxygen-
2 containing film.

1 13. The method as recited in claim 12 wherein the oxygen containing film is
2 formed during the electrolysis process.

1 14. The method as recited in claim 11 wherein the material coats one side of
2 the inert anode to create a bipolar electrode for use in multipolar electrolytic cells.

1 15. The method as recited in claim 8 wherein the distance between the anode
2 and cathode remains constant.

1 16. The method as recited in claim 8 wherein the electrodes can be arranged
2 in a vertical configuration.

1 17. The method as recited in claim 8 wherein the electrodes can be arranged
2 in a slanted configuration.

1 18. The method as recited in claim 8 wherein O₂ is the only gas generated by
2 electrolysis.

1 19. The method as recited in claim 16 wherein the vertical configuration of the
2 cell creates electrolyte recirculation pathways.

1 20. A method for electrolyzing alumina below 1000°C, the method
2 comprising:

- 3 a) supplying an electrolyte containing more than 35 mol% potassium
4 fluoride (KF) and more than 30 mol% aluminum fluoride (AlF₃);
5 b) injecting alumina with the electrolyte; and
6 c) subjecting the electrolyte to a voltage.